We claim:

1. A mesoporous material comprising:

a porous network; and

a stimuli responsive polymer dispersed within the porous network to control the transport of a molecular species through the porous network.

2. The material of claim 1, wherein the porous network includes materials of well-defined molecular dimensions.

3. The material of claim 1, wherein the porous network is externally and reversibly controlled to modulate the adsorption of the molecular species.

4. The material of claim 1, wherein the porous network changes thickness and surface energy as a function of temperature.

5. The material of claim 1, wherein the porous network comprises silica.

6. The material of claim 1, wherein the stimuli responsive polymer comprises a poly N-isopropylacrylamide polymer.

7. The material of claim 6, wherein the poly N-isopropylacrylamide polymer is extended and inhibits the transport of molecular species through the porous network at a low temperature.

8. The material of claim 6, wherein the poly N-isopropylacrylamide polymer is collapsed within the porous network and allows transport of molecular species through the porous network at a high temperature.

9. A method for forming a mesoporous material comprising:

modifying pores of a mesoporous material with a stimuli responsive polymer; and

maintaining the pores in an ordered porous network.

10. The method of claim 9, wherein the mesoporous material is formed such that the stimuli responsive polymer controls the transport and surface properties of the mesoporous material.

11. The method of claim 9, further comprising modifying the pores of the mesoporous material by atom transfer radical polymerization.

12. The method of claim 9, wherein the mesoporous material is formed using an acid catalyzed sol-gel process.

13. The method of claim 11, further comprising formation of an ordered mesoporous material prior to modifying by atom transfer radical polymerization.

14. The method of claim 9, wherein a versatile nanostructured surface is modified by poly(*N*-isopropyl acrylamide).

15. The method of claim 14, wherein the versatile nanostructured surface includes a nanoporous aluminum oxide formed via anodization.

16. The method of claim 9, wherein an inter-pore spacing of the porous network increased by at least about 30%.

17. The method of claim 9, wherein an inter-pore spacing of the porous network increased by at least about 40%.

18. The method of claim 9, wherein the stimuli responsive polymer comprises poly N-isopropylacrylamide.

19. The method of claim 9, wherein the mesoporous material comprises silica.

20. The method of claim 9, wherein the mesoporous material comprises anodic aluminum oxide.